the pro-oxidant heme to the vasodilator carbon monoxide and antioxidants biliverdin and bilirubin. Dietary antioxidants such as vitamin C can protect against vascular cell dysfunction (Carr et al 2000). We investigated whether vitamin C modulates GSH levels and HO-1 expression in human aortic SMC (HASMC) treated with oxidised LDL and examined the involvement of mitogen-activated protein kinases (MAPK) or PKC on HO-1 induction. HASMC were pre-treated in the absence or presence of vitamin C (100 μM) for 24 h and then treated with native (n), moderately (mod) or highly (ox) oxidised LDL (0–300 μg protein/mL, 0–24 h) in the absence of vitamin C. HO-1 protein expression was determined by western blot analysis and intracellular reduced GSH levels analysed using a fluorescence assay. Bilirubin generation was measured as an index of HO-1 activity. To investigate whether oxidised LDL acts via activation of MAPK pathways, phosphorylation of specific kinases were determined. In addition, HO-1 expression was determined in cells treated with U0126 (1 μM, MEK inhibitor), SB203580 (2 μM, p38MAPK inhibitor) or SP600125 (20 μM, c-jun-NH2-terminal kinase (JNK) inhibitor) before treatment with moderately oxidised (mod) LDL (100 μg protein/mL, 24 h). Expression of HO-1, bilirubin generation and GSH levels were elevated to a greater extent by modLDL, containing high levels of lipid hydroperoxides, compared with oxLDL, but unaffected by nLDL. Pretreatment of SMC with vitamin C or MAPK inhibitors significantly attenuated induction of HO-1 and elevation of GSH levels elicited by modLDL ($P < 0.05$, $n = 3–8$). Phosphorylation of p38MAPK, p42/p44MAPK and JNK were enhanced following acute exposure of SMC to oxLDL. These findings suggest that upregulation of HO-1 and GSH is a protective response to oxidative stress via activation of MAPK and that vitamin C affords cytoprotection by attenuating responses to oxidised LDL and hence supplementation may maintain vascular function in atherogenesis.

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Carr, A. C. et al (2000) *Circ. Res.* **87**: 349–354
Ross, R. (1999) *N. Engl. J. Med.* **340**: 115–126
Siow, R. C. et al (1999) *Cardiovasc. Res.* **41**: 385–394

Poster Session 1 – Tissue Engineering

072
Formation of alginate hydrogel scaffolds for tissue engineering by light activated release of calcium from photosensitive liposomes

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Light activated release of calcium entrapped in photosensitive liposomes is proposed as a method of controlled gelation of alginate for use as a cell scaffold. The ability to crosslink alginate via this method is dependent on the efficient entrapment of the calcium crosslinker (Ca^{2+}) and incorporation of a photosensitive lipid within the liposomal bilayer. Four liposome preparation methods producing vesicles of different sizes have been studied to evaluate $CaCl_2$ encapsulation. Triplicate preparations of multilamellar vesicles (MLV), small unilamellar vesicles (SUV), interdidgitation fusion vesicles (IFV) and large unilamellar vesicles (LUV) composed of dipalmatoylphosphotidylcholine (DPPC) 75 mol% and cholesterol (Chol) 25 mol% (total lipid 20 mg) were prepared, encapsulating a 0.2 M $CaCl_2$ solution. Unentrapped $CaCl_2$ was removed from the SUV by passing the liposomes down a short column of sephadex G-25, eluting with iso-osmotic buffered saline (20 mM HEPES, 1 mM EDTA buffer pH 7.4) and collecting fractions close to the void volume. Unentrapped $CaCl_2$ was removed from the MLV, IFV and LUV by washing the liposome suspension by centrifugation and repeating this process until no calcium could be detected in the supernatant. This was determined colorimetrically by using the calcium-sensitive dye arsenazo III, which undergoes a colour change upon binding with Ca^{2+} (Ca – AIII $\lambda_{max} = 656$ nm) (Westhaus & Messersmith 2001). Entrapment of $CaCl_2$ was quantified by measuring absorbance intensity using the arsenazo III assay before and after the liposomes had been ruptured using a 10%Triton X100 solution. MLV, IFV and LUV were sized using a Mastersizer (Malvern Instruments) and SUV using a Zeta Sizer (Brookhaven). The entrapment of $CaCl_2$ results (Table 1) indicate that the IFV have the greatest entrapment of $CaCl_2$ and are therefore more likely to cause gelation when the contents are released into an alginate solution. This was confirmed when each of these $CaCl_2$ entrapped liposome preparations were suspended into a 4% solution of sodium alginate (1 part liposome suspension 4 parts sodium alginate). The liposomes were ruptured by the addition of a few drops of 10% Triton X-100, then heated to 50°C and allowed to cool. Only the IFV-alginate sample formed a gel. In all the other liposome preparations the alginate remained viscous with no sign of crosslinking. The synthesis of the photosensitive phospholipid 1,2-bis(4-(n-butyl)phenylazo-4′-phenylbutyroyl)phosphotidylcholine (Bis-Azo PC) has been achieved following the method of Morgan et al (1985). This lipid has been shown to form stable liposomes in the dark when mixed in small quantities with DPPC and photo induced leakage of entrapped solute from these liposomes when exposed to light ranging from 360–470 nm (Bisby et al 2000). By incorporation of Bis-Azo PC into IFV we aim to enable the "light activated release" of entrapped Ca^{2+} and subsequent crosslinking of alginate in close proximity to the liposomes. This will provide a microstructure with a biologically compatible environment for three-dimensional cell proliferation.

Table 1 Liposome preparation characteristics

Vesicle type	Diameter (μm)	$CaCl_2$ entrapped per 20 mg lipid (mg w/w)
MLV	13 ± 0.8	0.05
SUV	0.15 ± 0.05	0.04
IFV	4.8 ± 0.58	2.69
LUV	9 ± 0.6	0.74

Bisby, R. H. et al (2000) *Biochem. Biophys. Res. Com.* **276**: 169–173
Morgan et al (1985) *Biochim. Biophys. Acta* **820**: 107–114
Westhaus, E., Messersmith, P. B. (2001) *Biomaterials* **22**: 453–462

Poster Session 1 – Pharmacy Education

073
A series of practical exercises allowing iterative development of laboratory skills

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In our experience, MPharm students enter the programme with generally poor practical laboratory skills and little or no experience of using any but the most basic laboratory equipment. As part of our programme, a series of three laboratory exercises used to be undertaken by Level 1 students, with the supposed intention of developing laboratory skills. In the authors' experience what actually happened was that students proved grossly incompetent in the first experiment and then moved onto a completely different experiment with similarly disastrous outcomes, which in turn was followed by a third fruitless exercise. The students gained little other than a sense of personal incompetence. The intention was to design a series of practical exercises with sufficient commonality to allow an iterative process of critical self-appraisal and improvement, while retaining a sense of development. This would then be followed by implementation and observation of the results obtained. Students were set a series of three enzymology experiments, each based upon studying the reaction velocity for the hydrolysis of varying concentrations of para-nitro phenyl phosphate by alkaline phosphatase. The reaction product – para-nitro phenol – is quantitated by colorimetry. In the first experiment, a Lineweaver-Burk plot is used to determine Vmax and Km under control conditions only, in the second the same parameters are determined under control conditions and in the presence of an inhibitor (Inorganic phosphate). The final exercise is identical to the second, but all observations are duplicated. Stages two and three each involve an approximate doubling of the number of tubes the students have to control, relative to the previous stage. In the first two stages, students are provided with complete instructions, but in the third, they have to take responsibility for planning the timing of the procedure. The series of exercises was undertaken by a class numerically dominated by MPharm students, but including a minority of other students. At each stage, student performance is assessed as "Unsatisfactory", "Satisfactory", "Good" or "Excellent". The grading is largely based upon the quality of practical results, but does also take account of the analysis of the data. The target grade is Excellent and this requires results with good linearity (Both the standardisation graph for para-nitro phenol and the Lineweaver-Burk plot) and good duplication of results. It also requires the absence of any major error

in data analysis. There was evidence of progress. The proportion of students who achieved the target standard of laboratory work (Excellent) began at 28.6% at stage one and rose by stage three to 43.5%, with 84.0% producing results considered Excellent or at least Good. No historical data exist that would allow a direct comparison of these outcomes with those achieved before the introduction of the new practicals, but folk memory does not indicate as high a level of success. The outcome was reasonably satisfactory. We were pleased to see an increase over the three weeks in the proportion of students who had achieved competence and that a large majority (84%) were producing reasonable results. However, there is still a way to go – 43.5% meeting the target standard is still not good enough. In summary, we believe that the opportunity for iterative improvement offered by these practicals is a useful tool, if not a complete toolbox.

074
The content of pharmaceutical biotechnology within pharmacy programmes

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By the end of 2004, some 160 biopharmaceuticals (recombinant therapeutic proteins, monoclonal antibody-based products used for therapeutic or in vivo diagnostic purposes, and nucleic acid-based products) had gained marketing approval within the EU and US. Some 350 million patients had been administered these products and approximately 25% of all new drugs approved since 2000 are biopharmaceuticals. Several hundred such products are in clinical trials and the sector revenues are projected to surpass $50 billion by 2010. It is therefore of interest to review the pharmaceutical biotechnology content of modern pharmacy degree programmes. A survey (commissioned by the European Association of Pharma Biotechnology; www.eapb.org) was undertaken to determine the pharmaceutical biotechnology content in the curriculum of a representative sample of European pharmacy programmes. The first six survey questions focused upon the lecture complement of biochemistry, microbiology and molecular biology, as these subjects underpin pharmaceutical biotechnology. The remaining questions focused upon pharmaceutical biotechnology itself, to determine when within the programme it is taught, and to what level in terms of lecture duration, laboratory content, syllabus and reading material recommended. The survey targeted 67 pharmacy departments throughout Europe. Forty replies (from 15 European countries) were obtained, a response rate of 59.7%. The mean number of lecture hours of biochemistry undertaken is 61.8 h, although a large standard deviation of ± 32.2 was recorded. It is invariably taught as a stand-alone subject, mainly in the second year. The mean number of lecture hours of microbiology undertaken is 52.4 h, but again a large standard deviation of ± 27.7 hours was recorded. It is taught mainly as a stand-alone subject in the second or third year. The mean number of lecture hours of molecular biology undertaken is 34 ± 16.4. It is taught either as a stand-alone subject or as part of a combined subject, mainly in the third year. The majority of programmes (82%) include core or elective courses in pharmaceutical biotechnology. The mean number of lecture hours delivered is 29.9 ± 18.6 and the courses are mainly taught in the third or fourth year. A marked variation of syllabus content from institution to institution was evident. Virtually all responses mentioned recombinant protein therapeutics and nucleic acid-based medicines. Upstream and downstream processing, as well as protein stability, formulation and delivery, were mentioned by some respondents. A full and comprehensive treatment of the field appeared lacking in a significant proportion of cases. A minority of respondents run associated laboratory practicals. Teaching resources listed also varied quite significantly, with most relying upon in-house generated course notes. At a European-wide level the survey suggests that pharmacy programmes are characterized by a marked variation in the content and level of pharmaceutical biotechnology delivered.

075
Are pre-registration cross-sector placements useful?

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The Royal Pharmaceutical Society of Great Britain (RPSGB) encouraged pre-registration trainees as part of a programme based solely in a hospital or community pharmacy to spend a minimum of two weeks in a secondary sector (RPSGB 2005). That is, a placement in community if they were a hospital-based trainee or vice-versa. During the pre-registration year students are also required to submit a portfolio of evidence (RPSGB 2005). Information regarding cross-sector placements and portfolio of evidence was also contained in the workbook in use at the time of the study (2001–2002). The main objectives of the cross-sector placement were, firstly, to develop awareness of the whole health service and practice in the other sector of the profession and, secondly, to enable the trainee to gather additional evidence for their portfolio for assessment. As there are no national studies investigating the usefulness or otherwise of such placements, the aim of this study was to investigate and describe the graduates' experiences during such cross-sector placements. Following a pilot study, questionnaires were sent to 1589 graduates towards the end of their pre-registration training, in June 2002. Graduates were asked their views and experiences on cross-sector placement arranged as part of their pre-registration training. In total, 807 responses were received (51%); 36% were training in hospital and 57% were community-based. In total 711 respondents (88%) stated having undertaken a cross-sector placement. These 711 respondents were asked to indicate their level of agreement with a number of statements namely: helped develop my awareness of practice in the other sector (Statement A), helped develop my understanding of practice in the other sector (B), helped develop my awareness of the health service (C), helped develop my understanding of the health service (D), enabled me to gather additional evidence that contributed to my portfolio of evidence (E), staff were too busy to offer sufficient training (F), two week placement is not long enough (G), allowed me to gain experience which helps in considering future career pathways (H), helped prepare me for the RPSGB registration exam (I), it was of no real use to me (J). Results are shown in Table 1. When asked how satisfied they were with the cross-sector placement, 25% were very satisfied, 58.5% were satisfied, 10% were dissatisfied and 2% were very dissatisfied. The other respondents indicated 'no opinion'. In response to the question 'How satisfied are you having chosen pharmacy as a career?', 21% were very satisfied, 53% were satisfied, 14% had no opinion, 11% were dissatisfied and 2% were very dissatisfied. For the majority of respondents in this study, the main objectives of the cross-sector experience, as identified by the RPSGB, have been met and the placements were found to be of use. Approximately one-third of respondents thought that other staff were too busy to offer sufficient training but further research is required to identify whether the expectations of such trainees was unduly high. Such training has resource implications for employers and cannot be ignored, particularly if consideration is given to increasing the duration of such a placement: 71% stated they felt two weeks was insufficient. Approximately three-quarters of respondents were very satisfied/satisfied with pharmacy as a career (74%), a slighter lower percentage than the same cohort (78%) in 2001 (McAteer et al 2004).

Table 1 Graduates' views on cross-sector placements (%)

	Strongly agree	Agree	No opinion	Disagree	Strongly disagree
A	37.5	57	2	3	0.5
B	29	63	3	5	*
C	13	53.5	17	15.5	1
D	11	48	20.5	19	1.5
E	34	52	6	8	*
F	9	23	10	49	9
G	31	40	10	17	2
H	22	65	7	5	0.5
I	14	46	13	23	4
J	3	6.5	9	42	39.5

*Only 1 respondent strongly disagreed.

McAteer, S. et al (2004) *Int. J. Pharm. Pract.* **12** (Suppl.): R59
RPSGB (2005) *Pre-registration trainee workbook*. www.rpsgb.org/pdfs/preregtrwb04–5.pdf

076
Graduates' perceptions of skills developed during the fourth year of the MPharm degree

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The fourth and final year of the MPharm degree should be at HE level 4 (QAA 2002). Previous research has questioned whether or not the MPharm

final year is at Masters level (Sie & Bates 2002). The learning outcomes of the MPharm degree were developed in line with the QAA Pharmacy benchmark statement together with the Royal Pharmaceutical Society of Great Britain (RPSGB) undergraduate degree accreditation criteria. Although students need to demonstrate competence for each learning outcome, students' views on such skills development have not yet been studied. Therefore, the aim of this study was to determine recent graduates' perceptions of the development of those skills, as identified in the 2002 QAA Pharmacy benchmark statement (QAA 2002). A questionnaire was sent to each of 93 graduates in 2004 from one school of pharmacy. The questionnaires, together with pre-paid return envelopes, were posted in August 2004. Replies were anonymous and so non-responders could not be followed-up with reminders. Students were asked to indicate from a list (Table 1) of which skills they had developed while in their fourth year of the MPharm. Thirty-nine questionnaires were returned completed. One questionnaire was returned undelivered and hence not completed, the respondent having moved away. Sixteen respondents were undertaking pre-registration training in community and 23 in hospital pharmacy. Other skills not listed that were identified by respondents were 'coping with stress/heavy workloads' (n = 1), 'confidence in public speaking' (n = 1) and 'patience, discipline' (n = 1). One graduate commented 'I really enjoyed the fourth year, it brought together everything I had learnt in the last 3 years and I feel it prepared me for the pre-reg year'. The majority of graduates indicated that most of the identified skills had developed during the final year of the MPharm degree, although it may appear that some students are graduating without, in their view, possessing one or more required skills. Graduates were asked which skills were developed in the fourth year. As such, students may have developed skills earlier in the degree. For example: 'ability to work within a quality management framework' is covered in the third year module; 'Quality Assurance', an 'ethical attitude and approach' is inculcated into the degree starting in year one; and 'statistics' is covered in earlier years of the course as well as in the fourth year. Skills may have been developed while undertaking employment or placements within or outside of pharmacy (e.g., 'responding positively to criticism' and 'leadership'). Further, skills may have been developed before studying for an MPharm degree. Further work is required to identify and explore skills development and the role of the MPharm in developing graduates fit for purpose during the pre-registration year and beyond.

Table 1 Level 4 skills as outlined in the QAA pharmacy benchmark statement and the number of fourth year MPharm students (n) who indicated development of each of the listed skills in their final year

n*	Development of each skill listed
38	Ability to work independently
38	Information retrieval
37	Writing skills
37	Interpersonal communication (oral)
37	Team-working
37	Independent study
37	Acquire, transform, interpret, evaluate data
36	Problem-solving
36	Self-motivation
36	Analysis & critical evaluation of literature
35	Time-management & organisation
35	Responding positively to criticism
34	IT skills
32	Work within personal limitations
31	Leadership
29	Dealing with conflict
29	Numeracy & computation
28	Ethical attitude & approach
24	Application of statistics
16	Work within a quality management framework

*Students indicated whether or not each skill listed had been further developed.

QAA (2002) *Quality assurance statement. Subject benchmark statement – pharmacy*. London. www.qaa.ac.uk/crntwork/benchmark/phase2/pharmacy_textonly.htm

Sie, D., Bates, I. (2002) Health Services Research & Pharmacy Practice Conference, Leeds p. 52

077
Pharmacy graduates' opinions on their pre-registration tutors: a GB survey

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Following a four year MPharm degree, graduates are required to undertake a period of 12 months pre-registration training with an Royal Pharmaceutical Society of Great Britain (RPSGB) accredited tutor (RPSGB 2005). Furthermore, a mentor may be appointed to guide graduate development and the mentor need not be a pharmacist. Although there have been some studies of pre-registration graduates (e.g., Mudhar et al 1996, John & Druce 2004), which enquired about the preparation of the undergraduate programme, there has yet to be a national survey of graduates' opinions on the role of the tutor in the pre-registration year. Therefore, the aim of this study was to investigate graduates' views and experiences of their appointed tutor. Following a pilot study, questionnaires were sent to 1589 graduates registered with the RPSGB for pre-registration training in June 2002 (i.e., towards the end of their training). Graduates were asked about a number of issues, including their views on their pre-registration tutor. In total, 807 responses were received (51%), 36% from those being trained mainly in hospital pharmacy and 57% primarily in community pharmacy. The remaining 7% of respondents were undertaking one of a variety of split pre-registration placements. A mentor had been appointed to 32% of trainees and not to 63%. Other respondents were unsure. Responses to questions regarding their RPSGB accredited tutor are provided in Table 1. They were asked: 'Do you believe your tutor . . . acted as a good role model?' (Statement A), '. . . was available to answer questions?' (B), '. . . provided feedback?' (C) and '. . . guided your learning?' (D). Logistic regression was used to identify factors that may predict responses namely graduation from a UK or non-UK school of pharmacy, sex, hospital- or community-based training, or if the student at enrolment on a pharmacy degree programme was a mature student (over 21 years old at the start of degree) or non-mature. The only statistically significant result regarding tutors was that more mature graduates were more likely to disagree that the tutor acted as a good role model (exp B = 2.17, $P = 0.036$). Further, it was found that respondents undertaking training in community were more likely to state that a mentor had not been appointed (exp B 2.51, $P < 0.001$). The results indicate that graduates' perceptions on the role of their tutor do differ and this may be due to one or more of a number of factors. This study has identified some graduates' perceptions, albeit a minority, that their tutors are, for example, always guiding their learning and yet others are never guiding learning. From the results some tutors are never acting as a good role model and 12% of tutors seldom, or less frequently, provide feedback. Clearly further in-depth research is required to identify whether such perceptions are real, and what should and could be done in such circumstances.

Table 1 Graduates' views on their tutors (%)

	Statement			
	A	B	C	D
Always	39	31	29	20
Usually	43	43	37	32
Sometimes	12	19	22	26
Seldom	4	5	7.5	12
Almost never	1	1.5	7.5	12
Never	1	0.5	1	3

John, D. N., Druce, L. A. (2004) *J. Pharm. Pharmacol.* **56** (Suppl.): S65

Mudhar, M. et al (1996) *Int. J. Pharm. Pract.* **4**: 59–64

RPSGB (2005) *Pre-registration trainee workbook*. www.rpsgb.org/pdfs/preregtrwb04–5.pdf

078
Views of pre-registration graduates on the transition 'from student to professional' and on the role of OSCEs for assessment during the pre-registration year

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The OSCE (objective structured clinical examination) is an assessment technique where students rotate around a circuit of stations and are required to solve

various practice-related problems (Barrows 1993). There has been a request that the OSCE be used as a method of assessment during the pre-registration year (Anon 2005). The Royal Pharmaceutical Society of Great Britain (RPSGB) has started conducting a major review of all the types of examination and assessment (Anon 2005). OSCEs are currently being used by some schools of pharmacy (Adcock 2001) and also in the practice setting; they are used for diagnostic, formative and summative purposes. The aim of this study was to establish views of pre-registration students as to whether or not the OSCE should be used as an assessment for registration purposes. Following a pilot study, questionnaires were sent to 1589 graduates registered with the RPSGB for pre-registration training in June 2002. The questionnaires were sent out on the day of the RPSGB registration examination. Graduates were asked about a number of issues including their views on the OSCE as a form of assessment in the pre-registration year. In total, 807 responses were received (51%), 83% of whom graduated from a GB school of pharmacy, 36% were training in hospital and 57% were community-based trainees with the remaining 7% undertaking one of a variety of split pre-registration placements. In response to the question 'At this stage in your pre-registration, have you made the transition from student to a person who can effectively practise effectively as a member of the pharmacy profession?', 26% agreed strongly, 64% agreed, 7% had no opinion and 3% disagreed/disagreed strongly. Students were informed what an OSCE was and then asked if they had previously heard of an OSCE before receiving the questionnaire. A total of 58% had heard of an OSCE before. Responses to other questions regarding this assessment are shown in Table 1. There was no significant difference (Mann–Whitney) for any of the three statements between those who had heard of an OSCE before the questionnaire being received and those who had not. In their view, only 3% of pre-registration trainees in this study disagreed that, towards the end of their professional training, they had made the transition from a student to a person who can practise effectively as a member of the pharmacy profession. It would be useful in future studies to obtain the views of tutors on whether or not their trainees had made such a transition. Recent graduates' views of the inclusion of an OSCE as part of the assessment process for registration with the RPSGB are mixed. As there has been no other large-scale survey of views of stakeholders on the use of OSCEs in the pre-registration year, the RPSGB, during its current review of examination and assessment (Anon 2005), may find these results of use.

Table 1 Graduates' views on OSCEs as assessments (%)

*SA	A	NO	D	DS	Statement
16	56	12	12.5	3.5	It would be a very useful part of the assessment during the pre-reg year
12	57	15	13	3	It would help assess if pre-regs are ready to practice as pharmacists
8	31	24	28	9	An OSCE should be part of pre-reg exam

*SA = strongly agree, A = agree, NO = no opinion, D = disagree, DS = disagree strongly.

Adcock, H. (2001) *Pharm. J.* **267**: 115–116
Anon (2005) *Pharm. J.* **274**: 499
Barrows, H. S. (1993) *Acad. Med.* **68**: 443–453

079
Why do students choose to read for a MPharm degree? Anonymous views of UCAS applicants who were invited to and attended an interview

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A trends analysis employed to model changes in student enrolment in UK schools of pharmacy since 1970 indicated that first year intake had increased progressively over the past 20 years and predicts intakes will exceed 2500 students by 2007 (Bates et al 2004). Reasons why students select to study pharmacy have recently been reported (Hatfield et al 2004) and identify a number of reasons for selecting pharmacy – liking for or ability in science, desire to care for or help people, motivation for pharmacy. This information was obtained from randomly selected UCAS (Universities and Colleges Admissions Service) applicants for admission in 2004 at one school of pharmacy. The aim of this study was to anonymously identify reasons for selecting pharmacy from those students who applied to read pharmacy and attended an interview for entry in 2005 to one school of pharmacy. Following piloting, the anonymous questionnaire, with a Freepost envelope, was handed to each student who attended an interview at one school of pharmacy in the period 17th November 2004 to March 16th 2005 for a place to study pharmacy, starting 2005. This school of pharmacy was not the same as the subject of study described by Hatfield et al (2004). Of the 231 eligible applicants, completed questionnaires were returned by 126 students (54.5%). Students were asked to indicate all listed reasons why they applied to read pharmacy. The numbers selecting each option are shown in Table 1. The other reasons given were research interests, helping to solve one's countries problems, opportunities for continual education, job security, and interesting and fulfilling job. In response to a question that asked for the main reason for choosing pharmacy, 27 indicated the science aspects of the course, 22 liked the work experience, 12 wished to help patients, 11 stated 'good career prospects', 11 chose 'healthcare profession' and 41 students gave more than one reason as the main reason for selecting pharmacy. This study has identified a number of similar reasons for selecting pharmacy but also a number of others not identified by Hatfield et al (2004). The method of identifying reasons in Hatfield's study was from UCAS application forms, which also contained student name and address. In the study described in this paper, a significant difference was that questionnaires were anonymous, that is, there was no possibility of linking responses to a particular UCAS applicant and so could not be identified. In conclusion, these two recent small studies undertaken at two schools of pharmacy identify common reasons for students selecting to study pharmacy at university and that the profession needs to be aware of such reasons if recruitment of sufficiently well-motivated and well-qualified students is to continue, when considering the increase in projected numbers of pharmacy students (Bates et al 2004).

Table 1 Reasons given by UCAS applicants for selecting to study pharmacy

n*	Reasons for selecting pharmacy
107	Good career prospects
88	Liked worked experience
79	Healthcare profession
100	Combines science subjects
91	Apply science to healthcare
8	Back-up/insurance choice
41	Full employment
66	Good salary
97	Working with people
102	Helping patients
31	Opportunity to travel
20	Family member in pharmacy
24	Recommended by family/friends
4	Recommended by careers advisers
38	Flexibility
5	Others

*Students could select as many reasons from a list corresponding to reasons in Table 1.

Bates, I. P. et al (2004) *Int. J. Pharm. Pract.* **12** (Suppl.): R18
Hatfield, K. et al (2004) *Int. J. Pharm. Pract.* **12** (Suppl.): R19

080
Usefulness of final year MPharm projects: students' opinions

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A prerequisite for the accreditation of the MPharm, as dictated by the European Directive 85/432/EEC and the resolutions of the EC Advisory Committee on Pharmaceutical Training, is that "a significant research project of three to six months' duration" is included within the course (RPSGB 2002). There are a number of stipulations for the research project, such as the inclusion of a critique of appropriate research methodology and suitable analysis of results, with the student being required to present a paper or dissertation on their project. Although research projects have been implemented for several years, and certainly before the introduction of the MPharm course, it is

apparent from the literature that little research has been conducted into the outcomes of the project, in particular from the students' perspectives. The aims of this study were to identify key learning outcomes for the final year projects and to evaluate whether students themselves believed the projects contribute to their development as independent learners. The survey was conducted through an interactive e-mail questionnaire, sent to all final year Pharmacy undergraduates at Aston Pharmacy School, with the exception of 10 students who participated in a pilot study during research methodology development. Opinions were sought as to the factors that influenced project selection, the perceived usefulness of the project and the specific learning outcomes from the project process. The sample comprised 92 students, of whom 51 (55%) responded. Analysis of the responses indicated that the type of research project (i.e. lab-based, survey-based) was most influential when determining project choice (57%), with the project topic (27%) and the project supervisor (16%) deemed less important. When considering the skills developed during the research project, the majority of students felt that they had developed the ability to analyse data (98%), learnt to work independently (92%), gained a better understanding of how scientists work on real problems (67%) and become better able to integrate theory and practice (63%). In addition, the majority of students felt that they had gained benefit in the skills of science writing (75%) and understanding primary literature (86%). However, 57% of students felt that they were not taught the necessary skills to carry out their research project, opining that there is a lack of experience in survey design and data analysis using packages such as SPSS. Overall, students agreed that the final year research projects were a necessary component of the MPharm degree course (69%), with most students indicating that they enjoyed being able to conduct a personal research project (76%). There are a number of RPSGB degree accreditation outcomes applicable to the final year research project, including the graduate taking personal responsibility for their learning and critically appraising information (RPSGB 2002). The results of this survey suggest that Aston undergraduates believe the final year research project equips them with the necessary skills to meet these outcomes, and the project process is enjoyable and valuable as a learning technique. Additional support on survey design and data analysis (Morris & Sharif 2004) may prove useful for specific projects.

Morris, C., Sharif, S. (2004) *Pharm. J.* **272**: 192–193
RPSGB (2002) *Accreditation of UK pharmacy degree courses*. London: RPSGB

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Usefulness of final year MPharm projects: supervisors' opinions

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The rapidly-increasing number of students enrolling on MPharm degree courses (Morris & Sharif 2004), combined with staff shortages (Lipsett 2004) and the requirement for every student to undertake a research project (RPSGB 2002), is creating increased workload for academic staff in UK pharmacy schools. The research project represents a substantial part of the final year of study; at Aston Pharmacy School, the project accounts for 20% of the overall degree mark. Although final year projects have been a fundamental component of undergraduate pharmacy education for many years, and indeed are a pre-requisite for MPharm degree accreditation (RPSGB 2002), to date no research appears to have been undertaken into the potential outcomes of the project, especially from the supervisor's perspective. The aims of this study were to consider the key skills supervisors believed students would gain as a result of undertaking the research project and to evaluate whether supervisors themselves gained any benefits from investing their time in supervising undergraduates during the project. The survey was conducted through an interactive e-mail questionnaire, sent to all final year project supervisors at Aston Pharmacy School. Opinions were sought as to the perceived usefulness of the project as a learning tool, the necessity of the research project within the MPharm curriculum, and the specific learning outcomes of the research process, as well as the skills required by students to undertake a research project effectively. Responses were received from 23 of the 29 supervisors of final year projects at Aston Pharmacy School (response rate 79%). All respondents indicated that the research projects were a useful learning tool, with 74% agreeing that the projects were a necessary part of the pharmacy degree course. When asked about the students' level of preparedness prior to undertaking the research project, the majority of respondents disagreed that students had an adequate understanding of the research process (78%), with 70% indicating that more time and effort should be devoted to teaching the relevant skills during the MPharm course. In terms of specific benefits that students gained as a result of undertaking a research project, 96% of respondents felt that students gained a better understanding of the research process and how scientists work on real problems, learnt to work independently and developed skills in the interpretation of results. A substantial number of respondents (26%) indicated that they had been unable to publish any results arising from final year projects; this may be for a number of reasons, including lack of suitable data and supervisor apathy. However, the majority indicated that the research projects have a positive influence on student interest in postgraduate research (65%), with 57% stating that final year projects have led to further research being generated. The results of this survey suggest that academics at Aston Pharmacy School value the final year research projects as effective learning tools, and consider them to be an important part of the undergraduate syllabus, despite there being apparently little benefit for such substantial time investment, other than future research project areas.

Lipsett A. (2004) *The Times Higher Education Supplement* 12 November
Morris, C., Sharif, S. (2004) *Pharm. J.* **272**: 192–193
RPSGB (2002) *Accreditation of UK pharmacy degree courses*. London: RPSGB

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Does the MPharm degree prepare students for pre-registration training? A preliminary, exploratory study using semi-structured interviews with pre-registration trainers

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The four year MPharm degree in the UK is accredited by the Royal Pharmaceutical Society of Great Britain (RPSGB 2002). A recent study (McAteer et al 2004) reported pre-registration graduates' views on how the MPharm degree prepared them for practice. However, this study did not identify views of those involved in their education and training. Therefore, the aim of this study was to identify and explore experiences and views of pharmacists on the preparedness of graduates for the start of pre-registration training. A semi-structured interview was chosen as the research method as it allows the interviewer to explore reasons for answers given and hence may help to explain results more so than responses to a self-complete questionnaire. A purposive sampling strategy was used to identify pharmacists involved with training of both hospital and community pre-registration graduates; interviews were conducted in late summer 2004. Nine interviews were conducted with trainers from south-west England and south-east Wales; three with pharmacists involved with training in community, five with hospital-based trainers and one with experience in both hospital and community pre-registration education. Interviews lasted between 10 and 40 min and were audio-recorded, transcribed and anonymised, with consent. Themes emerging from the data are identified with examples from the transcripts in italics. Pharmacists were generally satisfied with the graduates. For example, one hospital trainer commented "*now that it's four years compared to three, they are more mature and have quite a good clinical knowledge*" and a community trainer who is also an accredited pre-registration tutor explained "*I think they come out as very academically sound but it's noticeable that they're very well prepared for the pre-reg year*". Another common theme was that theory and practice need closer alignment, for example, "*before starting the pre-reg the more experience they can get the better they are. I think there are real benefits for mandatory experience as part of the degree*" (community trainer), "*students need more exposure to hospital sector but there are many issues with training capacity and trying to find enough time to take on more students*" (hospital trainer), "*need more patient contact*" (hospital trainer) and "*seeing the theory put into practice is what is needed*" (hospital trainer). Trainers were asked to identify gaps in graduates' skills, knowledge or attitudes and six could not identify anything major. Two mentioned confidence in performing pharmaceutical calculations and one hospital pharmacist stressed the importance of the relevant, pharmaceutical science aspects of degree to be retained, explaining that for health professionals "*pharmaceutics is unique to pharmacy*". In conclusion, practical experience of pharmacy while studying is perceived to be important but there are constraints on trainers' time. With increasing numbers of graduates forecast (Bates et al 2004), it will be interesting to see if the profession has the capacity to provide such experiences for students in future. This initial exploratory study has identified some positive views of a sample of those involved with training and tutoring pharmacy graduates. A larger quantitative study is required to identify whether these results, obtained from one region, are generalisable.

Bates, I. P et al (2004) *Int. J. Pharm. Pract.* **12** (Suppl.): R18
McAteer, S. et al (2004) *Int. J. Pharm. Pract.* **12** (Suppl.): R59
RPSGB (2002) *RPSGB accreditation of UK pharmacy degree courses*. http://www.rpsgb.org.uk/pdfs/eddegnewreq.pdf